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in the following listed application(s) or patent(s) for which the issue fee has been paid.

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Respectfully Submitted,



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(12) United States Patent
Yamazaki**(10) Patent No.: US 7,456,037 B2**
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- (54) **EL DISPLAY DEVICE AND A METHOD OF MANUFACTURING THE SAME**
- (75) Inventor: **Shunpei Yamazaki, Tokyo (JP)**
- (73) Assignee: **Semiconductor Energy Laboratory Co., Ltd. (JP)**
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1111 days.
- (21) Appl. No.: **10/747,864**
- (22) Filed: **Dec. 29, 2003**
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- Related U.S. Application Data**
- (60) Continuation of application No. 10/186,956, filed on Jul. 1, 2002, now Pat. No. 6,673,643, which is a division of application No. 09/615,264, filed on Jul. 13, 2000, now Pat. No. 6,432,561.
- (30) **Foreign Application Priority Data**
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- (51) **Int. Cl.**
H01E 51/40 (2006.01)
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- (52) **U.S. Cl.** 438/30; 438/99; 257/E21.352
- (58) **Field of Classification Search** 438/30, 438/99; 257/E21.352, E21.053, E21.358
See application file for complete search history.
- (56) **References Cited**
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(57) ABSTRACT

To decrease the number of layers while keeping or improving the performance of an EL element, so that the production cost is reduced. Cathodes (106, 107), a light emitting layer (108), an anode (109), and a passivation film (110) are formed on pixel electrodes (104, 105). Thereafter, the vicinity of the interface between the light emitting layer (108) and the anode (109) are doped with a halogen element through the passivation film (110) and the anode (109). This leads to formation of a hole conveying region (111) that functions as a hole conveying layer, thereby enhancing the light emission efficiency.

15 Claims, 8 Drawing Sheets